nearest relative, while the remains were buried in the house. On Ysabel (Solomon Islands) and also in Aneityum (New Hebrides) the body was buried in such a position that the head could be severed from the trunk, which was not itself exposed. At Ysabel the process was accelerated by lighting fires round the exposed head, from which the scorched flesh was easily peeled. At Aneityum female mourners watched the head until the soft tissues had decomposed. A special interest attaches to both these methods, since they contrast with the disposal of the dead by cremation practised in some of the western Solomons and New Ireland, while they agree in principle and in some degree in detail, with the methods of inhumation accompanied by the preservation of the skulls in vogue among the archipelagoes lying off the eastern extremity of New Guinea. These facts support a view held by the reviewer that the inhabitants of the Solomon Islands will be found to be divisible into two ethnic groups, the dividing line falling somewhere in the neighbourhood of the line of political division.

Dr. Brown mentions that on his early journeys in New Britain he was able to buy fowls of a small white breed in large numbers, and he suggests that these were indigenous. The interest of this observation is greatly increased by the fact that in many parts of eastern British New Guinea the natives maintain that thirty or forty years ago they possessed a breed of pure white fowls.

No praise could be too high for the plates with which this book is abundantly illustrated. One picture shows four men of the remote islet Lua Niua (Ontong Java), who speak a language "very closely related to the Samoan." So far as the writer knows this is the first adequate portrait to be published of these Polynesians, stranded long ago in Melanesia, who although they have retained their Polynesian features appear to have come into intimate contact with Melanesians since, as Dr. Brown informs us, they are divided into two exogamous classes. An alternate explanation favoured by Dr. Brown is that they are descended from a group of exogamous castaways from the Ellice group, who, it is assumed, were derived from Samoa at a time when that island was inhabited by a people having an exogamous clan organisation.

Two unfortunate slips occur in the description of the plates. The masks and figures shown in the upper figure facing p. 238 are from New Ireland (not from New Guinea), and the two masks facing p. 316, also attributed to New Guinea, certainly do not come from there. An insufficient index gives an inadequate idea of the real value of the book. C. G. S.

THE BUSINESS SIDE OF A UNIVERSITY.[1]

UP to the present time the development of the American university system has proceeded mainly by the multiplication of universities, and by increase in their endowments. The cost of university education has, however, steadily risen everywhere; and while it has been possible up till now to provide for expansion by increased contributions of funds from outside, it is clear that a limit exists to the possibilities of further increase. It follows that the question as to whether the efficiency of American universities can be increased by a better use of their existing resources is an important question which may become urgent in the future, even if it has not done so in the past.

Under the auspices of the Carnegie Foundation for the Advancement of Teaching, a report has been drawn up on "Academic and Industrial Efficiency." The author, Mr. Morris Llewellyn Cooke, claims to have studied the problem practically exclusively from the point of view of a business man, while freely admitting that there are other aspects of the question not dealt with in his report. In order to collect information, he visited eight universities and colleges, and in every case chose the department of physics for his inquiries, on the ground that the conditions prevailing in this department might be regarded as typical of those prevailing generally in the work of all departments. He notices a certain lack of intensiveness in the work of the colleges, and while admitting that a considerable amount of leisure is wanted for the teaching staff and those engaged in private research, points out that this affords no reason why janitors and gardeners should not carry on their duties out of lecture hours.

On the difficult question of administration, Mr. Cooke expresses fairly definite views. Three methods of administration are possible: firstly, "committee management"; secondly, what he calls the "military type," in which the whole of the direction falls on the shoulders of one man; and thirdly, what Mr. Cooke describes as "functional" management, in which the responsibility is divided amongst a number of individuals, each having complete authority over a limited range of duties. Observing that the system of government by committees does not prevail in the business world, the author objects to this system on the ground that it tends to produce lack of initiative, departmental autonomy, and lack of authority on the part of the heads of departments, especially in the matter of discipline when their decisions are liable to revision at the hands of a board or committee. The functional system is considered to be the best, though the author admits that the other systems are in many cases working well, and better than he would have expected.

Under the heading, "The College Teacher as a Producer," Mr. Cooke refers to the difficulty of increasing the efficiency of professors so long as their duties are so multifarious and varied as they are at present. He is quite astonished at the number of tasks they have to perform. Teaching, research, and administration alone form a group of duties, of which it is difficult for the same individual to combine more than two efficiently. But, in addition, it is becoming increasingly important for the professor to keep himself in touch with what is being done elsewhere, and this involves study of pedagogic methods as well as of the literature of his own subject. Moreover, the committee system, where it exists, makes increasing demands on his time. Yet Mr. Cooke finds professors spending time in taking inventories, keeping track of appropriations, mimeographing examination papers, and handling routine correspondence. "These things," he points out, "are clerical work, and should be handled outside of the teaching field, and not as a part of the teacher's duties." Further on he observes: "The high-priced presidents of our railways, banks, and steel companies would not dream of performing this variety of functions. They would refuse to do so, because they know they could not do them well. This part of raising the efficiency of the college professor will have to be done by building up central agencies for doing much of the work he does now, and for doing it so much better than he possibly can, that he will be glad to relinquish his responsibilities in these respects."

Passing on to the question of "research," the author directs attention to the danger which exists of sacrificing efficiency in other directions, especially in class-teaching, by attaching exaggerated importance to work of a research character. Mr. Cooke is here

[1] "Academic and Industrial Efficiency." A Report to the Carnegie Foundation for the Advancement of Teaching. By M. L. Cooke. Pp. vii+134. (New York City, 1910.)

opening up a question which it will be difficult to discuss adequately without raising controversies of a somewhat heated character, and it is clear that unless the subject be approached with the greatest caution by unprejudiced individuals, an inquiry may do harm instead of doing good. On one aspect of the question little difference of opinion will probably exist. Mr. Cooke directs attention to the case of a professor who felt that his ability lay in the direction of teaching, but who was more or less forced to undertake research owing to pressure from his colleagues. Another authority informed him that it was becoming increasingly difficult to discover profitable lines of research. To those whose main difficulty is to know what can be left uninvestigated and unpublished with the least sacrifice, these remarks must come as a surprise. They may suggest that facilities for research are not bringing relief in the quarters where it is most needed, and that there is something in Mr. Cooke's opinion that research ought to be subject to some kind of control or inspection. But would not such a system, if carried out under existing and not under ideal conditions, have the exactly opposite effect to that which Mr. Cooke desires? The difficulty is that nobody who is not engaged on a piece of original work or research can appreciate its significance and difficulty, and any attempt to assess such work from without would tend to the adoption of a standard of quantity rather than of quality; a premium would be placed on those investigations which were of the most superficial character. In this connection no analogy probably exists in business matters.

Tables are given showing, still for the department of physics, the relative cost and direct expense attributable to research and teaching. For the eight institutions under investigation, research absorbs on the average about one-third of the whole, but the author admits that physics is exceptional. Coming next to the question of economical use of buildings, attention is directed to the small number of hours in which each lecture-room is generally in use, and in this connection the earmarking of lecture-rooms for the exclusive use of one department is deprecated.

The next part of the report deals mainly with proposals for reorganising the administrative side of a college and for better control of its finances. Under the heading of "Functional Activities," the author suggests the establishment or reorganisation of the offices described under the following heads: Superintendent of grounds and buildings; interdepartmental janitor service; purchasing department; stores department; mail handling by a central office; bursar's department; disciplinarian; bureau of publicity; registrar; and bureau of inspection. Under the last heading it is suggested that perhaps the examination system may be found to exercise a useful function, and Mr. Cooke advocates the reintroduction of external examiners for the purpose. Under "Financial Administration" he advocates closer relations between the expenditure on different departments and their corresponding output of work. In a section headed "Physics Departmental Administration" he directs attention to the frequent expenditure of large sums on the purchase of apparatus which are only used for a limited period, and suggests that means should be devised whereby apparatus which have ceased to be useful in one particular college might be made available elsewhere. Under "Student Administration" he instances a few cases of slackness in respect of attendance; this is, of course, a matter that can be easily remedied from within. The rest of the report consists mainly of tables.

The author found everywhere the greatest willingness to cooperate with him in his inquiry, coupled by a keen desire to profit by any suggestions to which that inquiry might lead. No higher praise from a business man to a college professor could be given than his statement: "It would probably be impossible to find a group of men more willing to let one know the full measure of their ideals and of the work done than are the men of the universities." It is clear that if, and so far as, the American universities admit of reforms on the lines suggested, such reforms can and doubtless will be effected from within.

In an English review one is naturally somewhat concerned with the possible effects of Mr. Cooke's report on our own university system, and one cannot but feel a certain apprehension lest such a report falling into the hands of an outsider might be used as a tool for attempting to effect changes from without in a way which certainly would involve a very far-reaching temporary, if not permanent, waste of efficiency.

Now in most of our modern universities and colleges the supreme authority is vested in a council or board of governors consisting mainly of business men, and such a board possesses all the powers of inspection which Mr. Cooke desires to obtain in America. It also, in general, possesses the right of appointing and dismissing any member of the teaching staff, and the safeguards for securing that a professor shall only hold office as long as he continues to prove an efficient teacher are provided for to an extent which probably represents more than Mr. Cooke would consider desirable in his country. The teachers are often called on to furnish such boards with statements as to the progress of work in their departments, and may be called upon to reply to inquiries. In colleges receiving Treasury grants, further inspection on behalf of the Government is also contemplated, and detailed reports have to be furnished as to the work of the colleges and their departments. These reports include statements regarding research and the publication of original work. In regard to the keeping of students' records, different practices necessarily exist in different institutions, but this form of supervision is probably almost universal, and it is certain that in many instances we have got far more than Mr. Cooke would ask for in America.

In regard to the relative expenditure on teaching and research, it is certain that even in a department like physics we cannot furnish figures at all comparing with Mr. Cooke's. A not infrequent experience over here is to find teachers spending a not inconsiderable portion of their small salaries in the purchase of materials for researches conducted in the college laboratories. As regards the apportionment of grants in relation to the work of the departments, we here are usually in the position of having to make a little money go a long way, and the adoption of a standard based on numbers of students has certainly been carried beyond the limit conducive to the greatest efficiency. Last, but not least, there is probably not a college in this country which dispenses with the external examiner or the external examination.

The general conclusion is that the direction in which Mr. Cooke suggests reform tends rather towards assimilating the American university system to the system of most recent development in Great Britain. At the same time it does not necessarily follow that we ought to relax our efforts to move towards the existing American ideal. It may easily happen that the conditions for maximum efficiency are satisfied by some system which is intermediate between the two. While these remarks apply more particularly to such questions as inspection and relative importance of research, it cannot be denied that in the matter of general organisation much the same diversity prevails as Mr. Cooke finds in the United States. At

one centre the committee system is brought to bear on the most trivial details of domestic management; in another case a central authority practically decides even such matters as forfeiture of scholarships in cases of discipline. It may be that these divergences are the result of varying local conditions, but a study of them might well be extended to our universities.

Since the preceding notice was written, we have received a criticism of Mr. Cooke's report by President R. C. Maclaurin, of the Massachussets Institute of Technology, published in *Science*, xxxiii., 838, pp. 101–103 (January 20). Attention is particularly directed to the fact that most of the points raised in the report are not new. "It is full of commonplaces, and there is scarcely a question raised that has not been discussed *ad nauseam* by college professors and other officers. It is not lacking in confidence. One marvels at the temerity even of an 'efficiency engineer' who can lay down the law so definitely as to how to teach physics, how to conduct a recitation, how to carry on research, when most of us who have devoted our whole lives to such problems are far less confident." President Maclaurin specially condemns the "student-hour" standard of efficiency and the proposal for inspection of research, the futility of which has been pointed out above, and he instances his point by the following imaginary dialogue between Newton and the "superintendent of buildings and grounds, or other competent authority."

"*Superintendent:* Your theory of gravitation is hanging fire unduly. The director insists on a finished report, filed in his office, by 9 a.m. Monday next, typewritten, and the main points underlined. Also a careful estimate of the cost of the research per student-hour.

"*Newton:* But there is one difficulty that has been puzzling me for fourteen years, and I am not quite . . .

"*Superintendent* (with snap and vigour): Guess you had better overcome that difficulty by Monday morning or quit."

G. H. BRYAN.

THE MOTIONS OF THE PLANETS JUPITER AND SATURN.

THE January number of the *South African Journal of Science* contains an excellent paper by Mr. R. T. A. Innes on Le Verrier's theory of the motion of the planets Jupiter and Saturn. The title scarcely covers all that is in the paper, for the author concludes with numerical calculations, based upon formulæ developed by himself in the Monthly Notices for 1909, which must constitute a considerable step towards a revision of Le Verrier's theory.

Mr. Innes's chief criticism on Le Verrier is that he has taken 9·7367408 instead of 9·7365514 for the log ratio of the mean distances of Jupiter and Saturn, an error approximately of one part in two thousand.

The error is, however, considerably magnified when its effects upon the series representing the reciprocal of the distance between Jupiter and Saturn are considered, and the author's final conclusion is that the fourth significant figure always, and the third often, is incorrect in Le Verrier's perturbations. The error arose because Le Verrier used the mean distances corresponding in elliptic theory with the mean motions and neglected the systematic effects of the perturbations. Jupiter, for instance, on a distant planet like Neptune, may be approximately considered as coalescing with the sun, making that body heavier by one-thousandth part, and consequently the mean distance of Neptune greater by one part in three thousand.

The mean distance of Saturn needs correction by a greater fraction, nearly one part in two thousand; for when Jupiter is between Saturn and the sun, its attraction amounts to about four parts in a thousand of that of the sun, and the average is thus raised.

Le Verrier's omission is unimportant in all other cases. For the four inner planets the perturbations are so small that the third significant figure is insensible, and for Neptune and Uranus the increment due to Jupiter is practically the same and the ratio inappreciably altered.

We quote, for ready reference, a most valuable table :—

Planet	Log mean distance	
	Elliptic theory	Actual
Mercury ...	9·5878 2168	9·5878 2160
Venus ...	9·8593 3781	9·8593 3745
Earth ...	0·0000 0001	0·0000 0012
Mars ...	0·1828 9703	0·1828 9616
Jupiter ...	0·7162 3747	0·7162 3339
Saturn ...	0·9794 9655	0·9796 7915
Uranus ...	1·2829 0024	1·2830 9713
Neptune ...	1·4779 4661	1·4781 4316

Some *obiter dicta* in the paper are of great interest. Here is one :—

"So far as merely obtaining an ephemeris goes, it is probable that the method of special perturbations would have given one for 300 years or so with less labour than was involved in either the theories of Hill or Le Verrier."

This sets one thinking why we want the theories. Of course, we want the general results of theory, the first and foremost being that the mean distances are subject to no secular changes. And we want the outline of the theory of long-period inequalities with rough estimates of the numerical coefficients. But an ephemeris of Neptune could be obtained by special perturbations at 512-day intervals (using a power of 2); fifty intervals of 512 days each would cover the period from its discovery to the present day—a month's work.

It is beginning to be recognised that the "theory, good for ages, in which t alone has to be substituted," is incomplete. Le Verrier gave some results for the earth 100,000 years ago, based on his theory. If similar theories existed for the minor planets, we doubt, if we should see Eros falling within the orbit of Mars, the Trojan group being captured by Jupiter, and the zone corresponding to a mean motion double that of Jupiter being cleared of small planets. Possibly these phenomena are due to the secular effects of small causes not at present taken into account. We want, therefore, in the cheapest possible way, to multiply accurate ephemerides for comparison with observation.

THE ANTON DOHRN MEMORIAL FUND.

THE zoological station at Naples occupies a unique position among the biological institutions of the world. It is not only the oldest, the largest, and the best equipped of the biological stations, but it has maintained throughout its existence its thoroughly international character. The founder of this important institution, Dr. Anton Dohrn, died on September 26, 1909, and at the eighth International Zoological Congress, held at Graz during August, 1910, it was decided to raise a fund for an international memorial to commemorate his great achievement.

In case some doubt may be entertained as to the maintenance of the international character of the institution which is now under the management of Prof. Reinhard Dohrn, one of the sons of the distinguished founder, it may be remarked that Prof. von